

Supine versus prone position in percutaneous nephrolithotomy for kidney calculi: a meta-analysis

Peng Wu · Li Wang · Kunjie Wang

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Abstract

Background Supine position and prone position were the choice for percutaneous nephrolithotomy (PCNL). However, there is still no consensus on the optimal position for PCNL.

Methods A systematic literature review was performed, searching Pubmed, Embase, CENTRAL and reference lists for relevant studies. Data from all selected articles were extracted independently by two reviewers and analyzed by RevMan 5 software.

Results Four comparative studies involving 389 cases and 27 case series studies including 1,469 renal units of supine position and 4,837 renal units of prone position were identified. With reference to comparative studies, the mean stone length and the proportions of staghorn and multiple stones were comparable between two positions. There was no significant difference in terms of stone-free rate (risk ratio = 1.00, 95% confidence interval: 0.92 to 1.09; 82.4 vs. 82.1%) and bleeding. The rate of colonic injury in supine PCNL was approximate 0.5% and incidence of pleural injury of 0% was noted for both positions. Pelvic perforation and failed access were comparable

between supine and prone position. The operative times of supine position significantly decreased (65 ± 15 vs. 90 ± 15 min; mean difference = -24.76 , 95% confidence interval: -39.36 to -10.15), but no significant difference was found in mean days hospital stay. Analysis based on the case series showed larger proportion of staghorn and multiple calculi in prone position (45.8 vs. 31.7%), the supine PCNL had slightly lower bleeding and similar stone-free rate compared with the prone position.

Conclusions For general patients with kidney calculi, PCNL in supine position has similar stone-free rate compared with prone. Supine PCNL do not increase related complications. The operative times significantly decrease in supine position.

Keywords Kidney calculi · Meta-analysis · Nephrostomy percutaneous · Prone position · Supine position

Introduction

With the introduction of new technologies in endourology, the indications for open surgery for urolithiasis have decreased considerably. Minimal invasive treatment or surgery has become increasingly popular since its reduction in patients morbidity and period of convalescence.

Following the first description of percutaneous renal access with a patient in the prone position by

P. Wu · K. Wang (✉)
Department of Urology, West China Hospital, Sichuan University, 610041 Chengdu, China
e-mail: wangkunjie@gmail.com

L. Wang
Chinese Evidence-based Medicine Centre, West China Hospital, Sichuan University, 610041 Chengdu, China

Goodwin et al. [1], Fernstrom and Johansson [2] reported the first case of stone extraction through a nephrostomy tract in 1976. Since then, percutaneous nephrolithotomy (PCNL) has been widely accepted and its indications well codified. The rising number of PCNL procedures combined with increasing confidence and experience has caused researchers to modify the prone technique in an effort to improve success rate and overcome some limitations. Since 1998 when Valdivia-Uria described the lateral access with the patient in supine position [3], some urologists have used this approach for PCNL. The aim of this systematic review is to assess the outcomes and complications of PCNL for renal calculus in supine and prone position by performing a meta-analysis.

Methods

Literature review

In April 2009, we searched the following electronic databases: Pubmed (1966–2009.4), Embase (1977–2009) and Cochrane Central Register of Controlled Trials (2009 No. 2). The search strategy was “(Nephrostomy, Percutaneous) [MeSH Terms] AND (supine position OR dorsal decubitus OR dorsal position OR prone position) [Title/Abstract]”. The search was restricted to human subjects, English language and year 1998 to 2009. Because in 1998, Valdivia et al. [3] first described PCNL in supine position. In retrieved articles, reference lists were hand-searched to identify additional articles.

Criteria for inclusion were as follows: (1) patients with renal stones, (2) patients were treated with PCNL in supine or prone position, (3) outcomes including stone-free rate and complications, (4) randomized controlled trials (RCTs), comparative studies and case series studies.

Exclusion criteria were as follows (1) renal abnormalities (such as whole horseshoe kidney and ectopic kidney), (2) simple nephrostomy and renal biopsy, (3) patients of children, (4) unclear position of PCNL, (5) other position.

Data extraction

Titles and abstracts were first screened to determine which studies be excluded or retained, if necessary, we

read the full text to make a decision. Two reviewers independently extracted data from each selected study using a standardized form, and disagreements among the investigators were resolved by discussion until a consensus was reached. Where more than one publication of one study exists, only the publication with the most complete data will be included. The following information were extracted: author, date and country of study, study design, position of operation, characteristics of the patients (age, stone size, location), stone-free rate and complications, mean days hospital stay and operative times. We divided patients into supine and prone group according to patients' position in PCNL.

The primary endpoint was stone-free rate, which was defined as the diameter of stone fragments less than 4 mm determined by plain radiography or non-contrast computed tomography. The secondary endpoint was complications including bleeding, adjacent organ injuries (mainly colonic injury and pleural injury), pelvic perforation and failed access.

Statistical methods

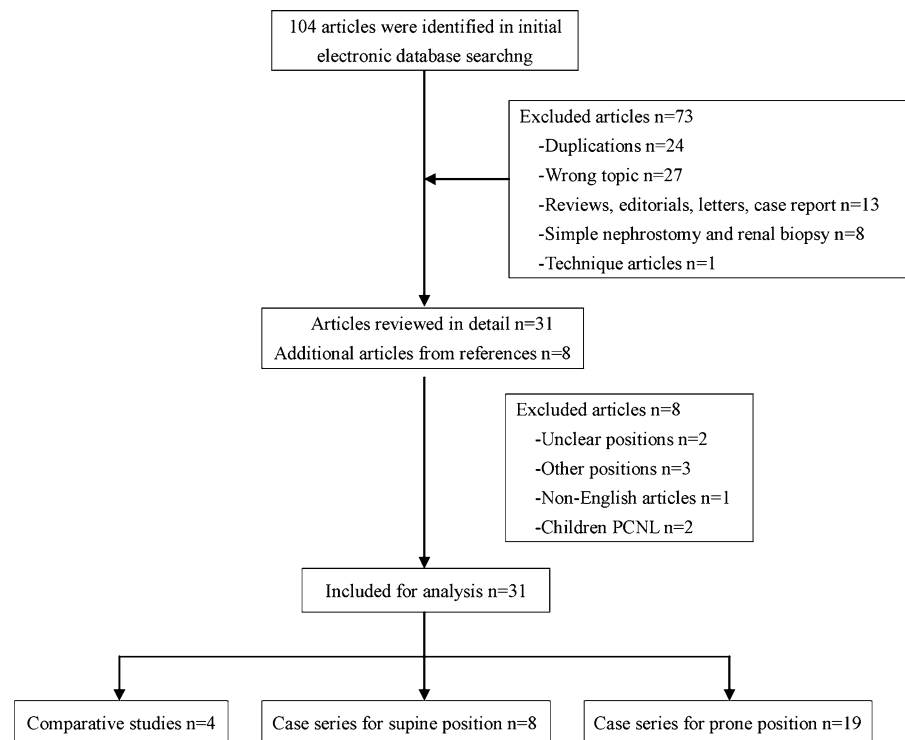
For comparative studies, the dichotomous outcomes (e.g., stone-free rate) results were expressed as risk ratio (RR) with 95% confidence intervals (95% CI). Data were pooled using the Mantel–Haenszel random effects model. For case series, the number of stone-free and the total number of patients were abstracted from each study, and these were summed over all studies and divided by the sum of total patients, giving a weighted average of the stone-free rates. Statistical analysis was performed using SPSS 15.0 and RevMan 5 software.

Results

Identification of studies

One hundred and four studies identified in searching database, and eight studies identified in searching reference lists, and 81 articles were excluded because of several reasons (Fig. 1). In all, 4 clinical comparative studies [4–7] and 27 case series [3, 8–33] were ultimately included for analysis in this study. The 31 studies [3–33] were published with English from 1998 to 2008. The information of included studies is

Fig. 1 Search and selection of studies for systematic review. This figure presents the process and results of studies selection



summarized in Tables 1, 2, 3, 4. Characteristics and pooled results of comparative studies are shown in Table 1, characteristics of supine and prone case series are presented in Tables 2 and 3, respectively. Pooled results of the included studies according to study design classification are shown in Table 4.

Comparative studies

Of four comparative studies, there are two RCTs [4, 5], a prospective non-randomized study [6] and a retrospective non-randomized study [7] together involving 182 renal units of supine position and 207 renal units of prone position. Other two RCTs [4, 5] both used blocked randomization schedule to allocate patients and described the baseline characteristics of two groups accurately which demonstrated high homogeneity, and carried out intergroup agreement tests. The treatment measures and outcome parameters had detailed description and carried out with blind method and conceal allocation. No patients dropped out.

Analysis results showed are as follows: (1) Stone burden: the mean stone length and the proportions of staghorn and multiple stones in supine and prone

groups were similar (29.2 ± 11.1 mm and 28.9 ± 10.8 mm, 9.1 and 6.5%, 41.3 and 52.2%), and there was no significant difference between supine and prone group in stone burden ($P = 0.82$, 0.47, 0.38, respectively); (2) Stone-free rate: there was no statistically significant difference between supine and prone group (82.4 vs. 82.1%; $RR = 1.00$, 95% CI (0.92, 1.09), $P = 0.93$) (Fig. 2); (3) Related complications: no statistically significant difference was found between supine and prone group in bleeding requiring transfusion [8.8 vs. 4.3%; $RR = 2.04$, 95% CI (0.92, 4.52), $P = 0.08$] (Fig. 3). One case of 182 renal units of supine position occurred colonic injury and no pleural injuries of 389 renal units in both positions. The rate of colonic injury in supine PCNL was approximate 0.5% and the incidence of pleural injury was comparable in two positions. Pelvic perforation and failed access were comparable between supine and prone position in comparative studies [2.7 vs. 1.4%, $RR = 1.86$, 95% CI (0.48, 7.20), $P = 0.37$; 1.6 vs. 1.4%, $RR = 1.08$, 95% CI (0.23, 5.11), $P = 0.92$] (Figs. 4, 5); (4) Mean days hospital stay and operative time: no statistically significant difference was found in mean days hospital stay [4.0 ± 1.3 days vs. 3.8 ± 1.1 days; $MD = 0.23$, 95% CI (-0.45, 0.92), $P = 0.51$] (Fig. 6), but there

Table 1 Characteristics of comparative studies

Study	Group	No. cases	Stone length (range)	No. staghorn stones	No. multiple stones	Stone-free rate (%)	Mean days hospital stay (days)	Operative time (min)	No. complications			
									Bleeding	Colonic injury	Pelvic perforation	Pleural injury
De Sio [4]	Supine	39	3.4 (2.5–5.1) cm	0	21	34 (88.7%)	4.3 days (2.2–8.4)	43 (25–120)	0	0	0	0
	Prone	36	3.3 (2.7–4.5) cm	0	19	33 (91.6%)	4.1 days (2.4–7.8)	68 (55–140)	0	0	0	0
Falahatkar [5]	Supine	40	40.6 ± 15.4 mm	9	NA	31 (77.5%)	3.3 ± 1.5	74.7 ± 25.1	8	0	2	0
	Prone	40	40.3 ± 16.3 mm	7	NA	32 (80%)	3.1 ± 1.9	106.87 ± 17.5	3	0	1	0
Shoma [6]	Supine	53	NA	3	17	47 (89%)	2.5	NA	5	0	2	0
	Prone	77	NA	3	40	65 (84%)	2.7	NA	3	0	2	0
Amon-Sesmero [7]	Supine	50	399.93 ± 58.2 mm ²	NA	NA	38 (76%)	5.9 ± 4.7	74.55 ± 25.54	3	1	1	NA
	Prone	54	416.36 ± 46.54 mm ²	NA	NA	40 (74%)	5.5 ± 4.1	91.82 ± 24.82	3	0	0	NA

NA not available

was a significant difference in operative time between supine and prone group [65 ± 15 min vs. 90 ± 15 min; MD = -24.76 , 95% CI (-39.36 , -10.15), $P = 0.0009$] (Fig. 7). The operative time of PCNL in supine position significantly decreased.

Case series studies

There were 8 papers [3, 8–14] of supine group and 19 papers [15–33] of prone group. Because two studies [15, 26] of prone position and one study [3] of supine did not describe the stone-free rate and another one study [33] of prone group did not describe the results of bleeding rate, these data were excluded when statistical analysis of corresponding results. Because the definitions of other complications reported in various researches are quite different, with a high heterogeneity, these data were not analyzed statistically.

In analysis based on case series studies, the proportion of staghorn and multiple stones in prone group was larger than supine group (45.8 vs. 31.7%). A total of 949 renal units with stone-free rate of 84.9% in supine group, and a total of 3,888 renal units with stone-free rate of 83.5% in prone group, there was no statistical difference between supine and prone group ($\chi^2 = 1.211$, $P = 0.271$). To compare transfusion rate, a total of 1,469 renal units involved with transfusion rate of 2.7% in supine group, and 4,752 renal units involved with 4.5% in prone group, there was a statistical difference between two groups ($\chi^2 = 9.457$, $P = 0.002$).

Studies synthesis

Analysis based on all studies [3–33], the proportion of staghorn and multiple stones in prone group was larger than supine group (45.8 vs. 32.5%). No statistically difference was found between supine and prone group in terms of stone-free rate (84.5 and 83.4%, respectively; $\chi^2 = 0.831$, $P = 0.362$). To compare transfusion rate for all studies, there was a statistically significant difference between supine and prone group (3.3 and 4.5%, respectively; $\chi^2 = 3.92$, $P = 0.048$).

Discussion

Currently, percutaneous nephrolithotomy is the treatment of choice for large renal stones, staghorn

Table 2 Characteristics of case series in supine position

Study	No. renal units	Stone length (range)	No. staghorn or multiple stones (%)	Stone-free rate (%)	Mean days hospital stay (range) (days)	No. complications			
						Bleeding	Colonic injury	Pelvic perforation	Pleural injury
Steele [8]	322	NA	33 (10.2%)	293 (91%)	3 (1–38)	12	0	3	1
Zhou [9]	92	1.2–18.5 cm ³	19 + 43 (67.4%)	76 (82.6%)	NA	1	0	0	0
Rana [10]	191	12 ± 3.2 cm ²	39 + 65 (54.5%)	154 (84%)	2 (1–7)	7	0	2	1
Scoffone [11]	127	23.8 ± 7.3 (11–40) (median: 24.5) mm	42 (33.1%)	111 (87.4%)	5.1 ± 2.9 (3–14; median: 4.7)	4	0	5	0
Manchar [12]	62	316 ± 278 (80–1,700) mm ²	7 (11.3%)	59 (95%)	NA	2	0	0	0
Ng [13]	67	607.5 (36–2,670) mm ²	10 (14.9%)	51 (76%)	10.7 (1–135)	3	0	0	0
Valdivia [3]	520	NA	NA	NA	NA	3	0	1	0
Neto [14]	88	3.6 ± 1.9 (1–8) cm	43 (48.8%)	62 (70.5%) ^a	5.4 ± 3.1 (2–21)	7	0	1	0

NA not available

^a The diameter of stone fragments less than 5 mm as the standard of stone clearance

calculi, stones resistant to fragmentation, or stones occurring in kidneys with an abnormal anatomy [34]. Percutaneous nephrolithotomy has been widely accepted and its indications well enlarged, replacing open surgical removal of large renal calculi at most urologic institutions worldwide. Traditionally, PCNL has been performed in the prone position, which is known to provide a larger surface area for the choice of puncture site, a wider space for instrument manipulation, unlimited instrument excursions, feasible multiple accesses and a possibly a lower risk of splanchnic injury. Nonetheless, it also has several disadvantages, including patient discomfort, the need for several assistants to correctly position the patient before surgery and for additional intraoperative changes of the decubitus in case of simultaneous retrograde instrumentation of the ureter, a more evident risk related to pressure points, circulatory and ventilatory difficulties (especially in the morbidly obese, kyphotic and debilitated patients) [35].

In 1998, Valdivia et al. [3] first described PCNL in the supine position, advocating several benefits for the patients, especially in those at higher anesthesiologic risk. Unquestionably, the supine position has several advantages for both the patient and the operator including less demanding and time consuming for patient positioning, more comfort for both patient and surgeon, low pressure in the renal pelvis and reducing the risk of fluid absorption and facilitating spontaneous stone fragment evacuation and ready simultaneous ureteroscopic access [36]. De la Rosette reviewed some current clinical articles about supine and prone PCNL, and access the efficacy and safety of the prone and supine position that for obese patients and staghorn calculi, prone PCNL appears to be associated with decreased operative times with similar bleeding rates and slightly better stone-free rates than supine PCNL [37]. But for normal healthy individuals, there is still controversy in efficacy and safety to compare supine and prone PCNL.

Various modifications to patient positioning for PCNL emerged as urologists understood more of the surface anatomy of the kidney and related viscera. When patients were placed in the supine position for percutaneous nephrolithotomy, the ipsilateral flank was elevated with a 1L or 3L water bag, depending on patients' body sizes. If simultaneous retrograde URS was contemplated, the patient would be put into the supine lithotomy position. Otherwise, the patient

Table 3 Characteristics of case series in prone position

Study	No. renal units	Stone length (range)	No. Staghorn or multiple stones (%)	Stone-free rate (%)	Mean days hospital stay (range) (days)	No. complications			
						Bleeding	Colonic injury	Pelvic perforation	Failed access
Yadav [15]	849	NA	202 (23.8%)	NA	NA	6	0	1	11
Aron [16]	121	4,800 (3,089–6,012) mm ²	121 (100%)	102 (84%)	4 (2–16)	18	NA	5	3
Koo [17]	223	NA	24 (10.8%)	174 (78%)	6.3 ± 3.0	1	NA	2	NA
Basiri [18]	100	NA	NA	81 (81%)	NA	0	0	1	0
Basiri ^a [19]	50	24 ± 12.7 mm	NA	43 (86%)	NA	2	0	0	7
Osman [20]	315	NA	135 (42.9%)	304 (96.5%)	NA	1	0	2	0
Holman [21]	300	753 (400–3,500) mm ²	119 (39.7%)	292 (97.3%)	4.8 (3–14)	14	1	NA	7
	28	NA	25 (89.3%)	27 (96.4%)	NA	0	0	NA	3
Yadav [22]	48	426 (150–1,600) mm ²	NA	39 (81.3%)	2.4 (1–7)	5	0	0	1
Sofikerim [23]	114	NA	52 (46%)	110 (97%)	5.2 (3–18)	1	NA	NA	NA
Wong [24]	811	7.8 ± 3.7 cm ² (1.5–30 cm ²)	389 (47.9%)	578 (71.3%)	2.7 ± 0.7 (1–15)	89	3	NA	3
Tefekli [25]	100	31.46 ± 13.16 mm	NA	NA	3.78 ± 0.84	8	0	0	7
Ziaee [26]	39	640.2 ± 412.5 (156–2,000) mm ²	39 (100%)	26 (66.7%)	NA	4	NA	NA	NA
Portis [27]	68	40.5 (2–150) mm	15 (22.1%)	53 (77.9%)	NA	2	NA	NA	NA
Raza [28]	204	3.39 ± 1.75 cm ²	38 (18.6%)	144 (70.6%)	2.9 ± 1.7 (1–15)	4	0	0	2
Meinbach [29]	167	2.91 ± 1.9 cm	57 (34.1%)	156 (93.4%)	NA	17	1	0	0
Margel [30]	1,155	2.5 ± 0.85 (1–4.5) cm	780 (67.5%)	983 (85.1%)	3.3 ± 2.6 (1–32)	35	5	NA	1
El-Assmy [31]	60	14.5 ± 8.7 mm	45 (75%)	53 (88.3%)	4.9 ± 3.1	5	0	1	2
Pearl [32]	85	375 ± 442 (30–2,304) mm ²	NA	80 (94.1%)	4.2 ± 2.1 (2–17)	MeanHbLoss	NA	NA	NA
Sergeyev [33]						2.28 ± 1.36 (0.1–6.5) g/L			

NA not available

^a No. 50 duplications; MeanHbLoss: the amount of mean hemoglobin loss

Table 4 Pooled results of the included studies

Designs	No. studies	No. renal units		No. stone-free (%)		No. bleeding (%)		No. colonic injury		No. pelvic perforation		No. pleural injury		No. failed access		Mean days hospital stay (days)		Operative time (min)	
		Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone	Supine	Prone
Comparative studies	4	182	207	150 (82.4%)	170 (82.1)	16 (8.8)	9 (4.3)	1	0	5	3	0	0	3	3	4.0 ± 1.3	3.8 ± 1.1	65 ± 15	90 ± 15
Case series studies	27	1,469	4,837	806 (84.9)	3,245 (83.5)	39 (2.7)	212 (4.5)	0	10	12	12	2	35	1	49	–	–	–	–
All studies	31	1,651	5,044	956 (84.5)	3,415 (83.4)	55 (3.3)	221 (4.5)	1	10	17	15	2	35	4	52	–	–	–	–

Pooled results of the included studies according to study design classification are shown in Table 4

could remain supine for the whole procedure. The angle of entry was horizontal or slightly inclined anteriorly taking the plane of the operating table as horizontal, which may facilitate the spontaneous evacuation of stone fragments [10]. A posterior calix was more commonly entered even though the site of puncture was near the midaxillary line and with the aforementioned angle of entry. This may be related to the effect of the saline bag, which helped in elevating and rotating the kidney. Falahatkar [5] performed complete supine PCNL with no rolled towel under the flank and no change in leg position. We did not distinguish the results of two kinds of supine positions deliberately when analysis of combined results. Because mostly reported supine PCNL adopted modified position, only one literature reported the results of complete supine PCNL and we considered that there was no essential difference in basic principles and surgical techniques between two supine positions.

Based on the analysis of these four clinical comparative studies [4–7], supine PCNL has decreased operative times with similar stone-free rates, bleeding rates and other related complications. A ureteral catheter is commonly fixed in a lithotomy position before turning the patient to access the flank that often prolongs the duration of the procedure. In addition, the prone position is often associated with a limitation in respiratory movement. Ventilatory difficulties may occur while prone and control of the airways by the anesthesiologist is more demanding. Nevertheless, with the patient supine, ureteroscopic procedures and PCNL can be done simultaneously. Moreover, this supine position is more comfortable for the patient, which might enable the use of less intense anesthesia as is reported in Neto's study [14]. The supine position allows for more rapid access to the airway, and therefore may be less hazardous, especially in patients with compromised cardiopulmonary function or morbid obesity or in those who require a prolonged procedure.

The stone-free rates of supine and prone PCNL are similar in comparative studies of high quality. Based on the analysis of case series and synthesis all of studies, the available data suggest that supine PCNL has slightly better stone-free rates without statistically significant difference. Through analysis the characteristics of involving studies, the patients of prone group were significantly more than supine group (4,837 vs. 1,469). And the proportions of

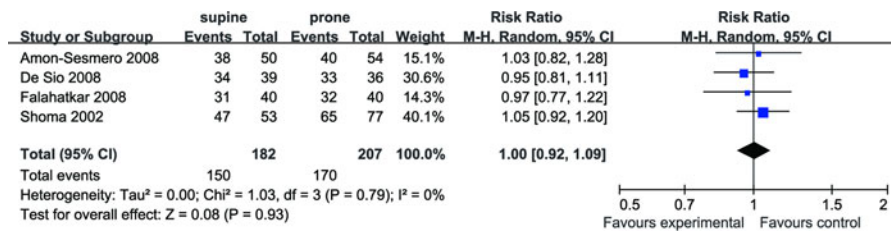


Fig. 2 Forest plot of comparison: stone-free rate (experimental = supine, control = prone). Stone-free rate of percutaneous nephrolithotomy in supine and prone position in randomized

controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

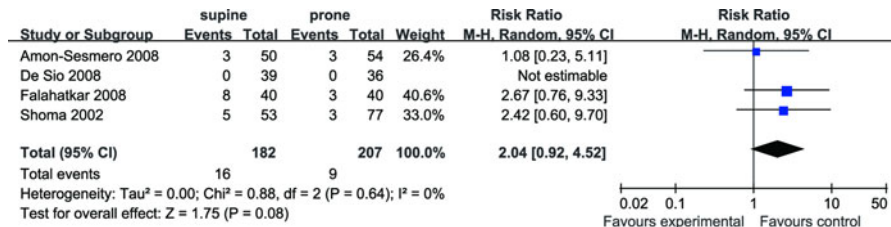


Fig. 3 Forest plot of comparison: bleeding rate (experimental = supine, control = prone). Bleeding rate of percutaneous nephrolithotomy in supine and prone position in randomized

controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

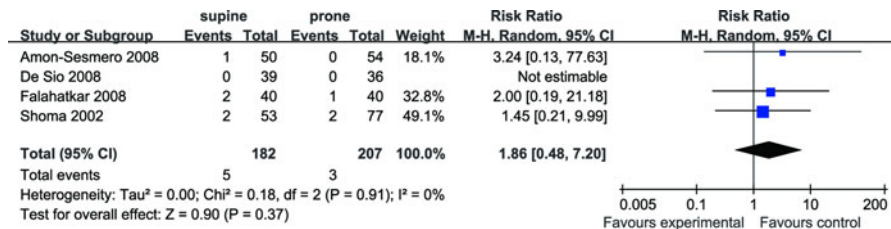


Fig. 4 Forest plot of comparison: pelvic perforation (experimental = supine, control = prone). Pelvic perforation of percutaneous nephrolithotomy in supine and prone position

in randomized controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

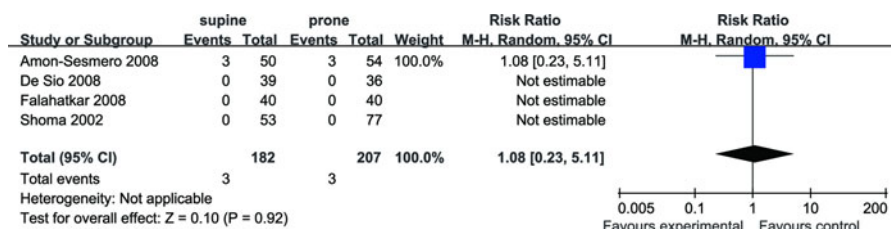


Fig. 5 Forest plot of comparison: failed access (experimental = supine, control = prone). Failed access of percutaneous nephrolithotomy in supine and prone position in randomized

controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

staghorn and multiple stones in prone group were larger than supine group (45.8 vs. 31.7%). The heterogeneity of patient characteristics (body

mass index, stone burden) across the studies partially hindered an objective and reliable synthesis of extrapolated data.

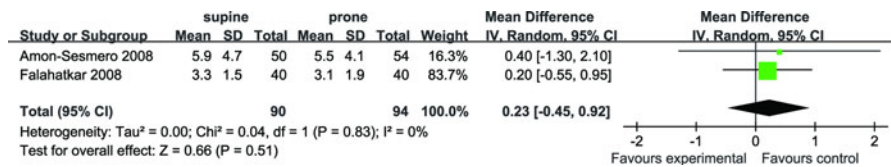


Fig. 6 Forest plot of comparison: mean days hospital stay (experimental = supine, control = prone). Mean days hospital stay of percutaneous nephrolithotomy in supine and prone

position in randomized controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

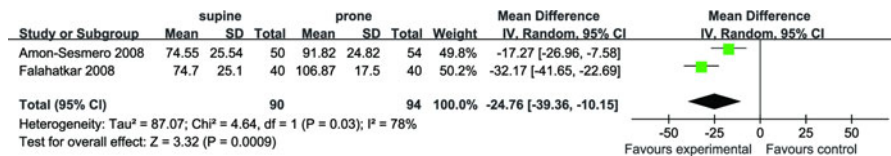


Fig. 7 Forest plot of comparison: operative time (experimental = supine, control = prone). Operative time of percutaneous nephrolithotomy in supine and prone position in

randomized controlled studies and a resultant meta-analysis using random effects models. *CI* confidence interval

Bleeding is a common complication of PCNL, which large series report a 3–10% rate of acute bleeding requiring transfusion [37]. Conservative measures including adequate hydration, prevention of hypothermia, clamping the nephrostomy tube and hemostatic drugs are adequate to treat mild bleeding [38]. Moderate hemorrhage demands blood transfusion in addition to conservative measures. Falahatkar reported transfusion rate of 20% of PCNL in the supine position [5]. High rate of transfusion may be due to not having enough experience and less familiarity with this approach. Considering the standard of transfusion is difficult to unify, mostly depending on the patients' physical ability and surgeons' experience, the transfusion rate is close related to the surgeons' proficiency for PCNL.

The potential advantages of the supine position, which are neglected by the majority of urologists, perhaps due to lack of experience and fear that the supine position might increase the risk of colonic injury. In the traditional prone position, only 0.2 to 0.5% of the patients had colonic injuries [39]. In our review, only one colonic injury occurred in supine position, which was reported by Amon-Sesmero [7] and no pleural injury occurred. The rate of colonic injury in supine PCNL from comparative studies was approximately 0.5% similarly with the previous reports of prone position. Supine PCNL does not increase the risk of colonic injury and is still a relatively rare complication. The colon floats away from the kidney when the patients are in supine

position; this makes the colon less likely to be injured by a puncture made in the posterior auxiliary line [4]. With the patients in the prone position, the colon could be pushed against the lateral surface of the kidneys, but in the supine position, it falls anteromedially and thus well apart from the puncture paths [40]. Considering each study applied different puncture access, the pleural injury is close related to the surgical approach. With the increase of urologists' surgical experience of PCNL, the incidence of pleural injury decreased and it was easy to handle.

Limitation of supine PCNL includes a more difficult nephroscopy because of decreased filling of the collecting system [35]. Consequently, the collecting system is constantly collapsed, and as a result, the surgical field is relative small for nephroscopic maneuvers. Despite all the comfort and ease of this procedure, the technical difficulty appears to be that of approaching the upper calix, especially if it is placed excessively medially, which is more pronounced on the left side [6]. Ng et al. [13] reported the upper calix almost could not approach. Due to the surgeon needs professional training to master this technique [35], the clinical application of supine PCNL is confined.

In drawing up this systematic review, the paucity of comparative studies on supine versus prone PCNL is the most difficulty. Because each case series study paid attention to the different results, and the definition of complications of PCNL reported in

some researches are quite different, with a high heterogeneity, these studies could only be excluded, which may result in underestimated of the secondary outcome measurements. These inevitable methodological shortcomings reduce the level of evidence.

In conclusion, for general patients with renal calculi, the operative time significantly decrease in supine position, and the stone-free rate of supine are similar with prone position. Supine PCNL do not increase related complications. The supine PCNL would be better choice for those patients with high risk of anesthesia.

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